

Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Experimental Observation of Hierarchy in Temporal Quantum Correlations HAO-CHENG WENG, CHEN-YEH WEI, National Tsing Hua University, HUAN-YU KU, National Cheng Kung University, SHIN-LIANG CHEN, Freie Universität Berlin and National Cheng Kung University, YUEH-NAN CHEN, National Cheng Kung University, CHIH-SUNG CHUU, National Tsing Hua University — The concepts of entanglement (or inseparability), steering, and Bell nonlocality form a logical hierarchy as manifested by the strict hierarchy of the entangled states, steerable states, and Bell-nonlocal states as well as the securities of the standard quantum key distribution (QKD), one-sided device-independent QKD, and device-independent QKD. In this work, we report the experimental observation of the hierarchy in their temporal analogues— the temporal inseparability, temporal steering, and temporal CHSH inequality (or nonmacrorealism). These temporal quantum correlations, which quantify the two-time correlation of a quantum state with characterized or uncharacterized measurements, can exhibit distinct dynamics in quantum channels as a consequence of the hierarchy. Using the superconducting qubits provided by the IBM Quantum Experience, we observe the signature of the hierarchy in a depolarizing quantum channel while investigating the sudden death of these temporal quantum correlations. In addition, we also study how one may use these temporal quantum correlations to signify the non-Markovianity and benchmark the security of QKD.

Hao-Cheng Weng
National Tsing Hua University

Date submitted: 28 Jan 2020

Electronic form version 1.4